UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF NEW JERSEY

RAJESH KUMAR,	:	Case No. 2:12-cv-06870-KSH-PS
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Plaintiff,	:	
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	:	
	:	**ORAL ARGUMENT**
v.	:	**REQUESTED**
	:	
THE INSTITUTE OF ELECTRICAL AND	:	
ELECTRONICS ENGINEERS, INC., a	:	Motion Date: March 16, 2015
New York corporation,	:	
	:	
Defendant.	:	
	:	
	:	

PLAINTIFF'S MEMORANDUM OF LAW
IN SUPPORT OF MOTION FOR SUMMARY JUDGMENT

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I.   PRELIMINARY STATEMENT

Plaintiff Rajesh Kumar moves for summary judgment on the issue of

Defendant IEEE's liability for copyright infringement, based on its publication of

an article that appropriated protected elements of Dr. Kumar's doctoral thesis.

This case concerns Dr. Kumar's copyright in text, illustrations and computer

code he created to describe his innovative work in robotics programming. These

portions of the thesis describe experiments he ran to validate the feasibility of his

program for instructing a robotic tool to work cooperatively with a human user – a

problem he researched for over five years at Johns Hopkins University ("JHU").

The infringing IEEE article was ███████████████████████████████

██. The article

copies the heart of the thesis. ████████████████████████████████

████████████████, the article describes the same experiment as Dr. Kumar's

thesis, using virtually the same text; the same illustration with only immaterial

revisions; and the same computer code translated into another computer language.

Discovery has revealed that the key illustration, or "task graph," in IEEE's

article was in fact copied from Dr. Kumar's task graph, using his source file. This

direct evidence of copying suffices to establish infringement. Additionally, the

article meets the "substantial similarity" test for copyright infringement. The

authors indisputably had access to Dr. Kumar's thesis material: one was a secondary advisor on the thesis, and the other was provided with, at a minimum, unpublished versions of the task graph. The similarities between the works are striking, to both expert and lay observers. Accordingly, Dr. Kumar is entitled to summary judgment that IEEE is liable for copyright infringement.

II.   STATEMENT OF FACTS

A.   Dr. Kumar's Thesis Was Innovative and Original, Reflecting Over Five Years of Research and Experimentation

Plaintiff Kumar is a computer scientist whose work has focused on medical robotics, computer-assisted surgery and other human-machine interactions. Declaration of Dr. Rajesh Kumar ("Kumar Decl.") ¶ 3 & Ex. B. He has worked in academia and private industry, including in a senior position at Intuitive Surgical, Inc., where he developed the prototype that led to the widely used da Vinci Si robotic surgery platform. *Id*. ¶ 3. He has published over 100 patents and applications, books, chapters, articles and peer-reviewed conference papers. *Id*. ¶ 3 & Ex. B pp. 2-12. Dr. Kumar has served as a conference organizer and article reviewer for Defendant IEEE. *Id*. Ex. B at 1-2. IEEE editors continued to solicit Dr. Kumar's expertise for peer review even after this lawsuit was filed. *Id*. Ex. C.

Dr. Kumar began his Ph.D. research as a graduate student in computer science at JHU in 1996. Kumar Decl. ¶ 5. There, he researched and developed

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new software architectures for computer-assisted surgery, focusing on systems in which humans and robots perform surgical and other tasks cooperatively. *Id.* He worked primarily with JHU's "steady hand robot," a modular test bed that he helped develop and for which he wrote all of the robot control application programming interface software needed during his graduate student tenure. *Id.* The steady hand robot allows a user to manipulate a tool jointly with the machine, in a manner that reduces human tremor and enables extreme precision. *Id.*

Dr. Kumar's Ph.D. dissertation ("Thesis"), published in 2001, is entitled "An Augmented Steady Hand System for Precise Micromanipulation." Kumar Decl. ¶¶ 2, 6, Ex. A. The Thesis is based on his five-plus years of research at JHU. *Id.* ¶ 6. Dr. Kumar led and was personally responsible for the work described in the Thesis, which was funded in part with National Science Foundation grants. *Id.*

The Thesis is Dr. Kumar's original solution to a complex computing problem: how to generate simple, modular programming instructions (named "primitives") that can be combined and transparently implemented to control the steady hand robot in order to execute complex, microscopic tasks in coordination with a human operator. *Id.* ¶ 7 & Ex. A, at 6. The Thesis explains how to use "task modeling" to improve control of the steady hand robot, thereby enhancing its potential future use in microsurgery and other tasks requiring both extreme precision

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and human decision-making. *Id.* at 16-18, 38-48, 79-85. More specifically, Dr. Kumar used visualizations, called "task graphs," to both visualize the complex tasks and to help implement the corresponding computer code that instructs the robot to perform complex motions – some human-initiated, some machine-initiated. *Id.* ¶ 7 & Ex. A, chapter 4. These task graphs decompose complex tasks into a series of more basic modules, each signifying a particular set of coding instructions. *Id.* ¶ 7 & Ex. A at 38; Expert Declaration of J. Kenneth Salisbury Jr. ("Salisbury Decl.") ¶ 15.[1]

The Thesis provides several increasingly complex example scenarios for implementing and testing Dr. Kumar's task graph programming. Kumar Decl. ¶ 8 & Ex. A at 51-77. One experiment is based on "retinal vein cannulation" ("RVC"), a microsurgical technique that involves insertion of a micropipette (a minuscule tube) into a blood vessel in the retina in order to inject medicine. *Id.* ¶ 8 & Ex. A at 68-75. Dr. Kumar had practical reasons for choosing RVC as an experimental example: porcine (pig) eyes were readily available for research purposes, and a small business had donated the necessary needles, thus providing a non-clinical setting in which Dr. Kumar could perform the numerous trials needed to test the feasibility and effectiveness of his code. *Id.* ¶ 8 & Ex. A at 69-75, 81. Dr. Kumar used the robot to

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[1] For Dr. Salisbury's qualifications, see *id.* ¶¶ 5-9, along with the C.V. and expert report submitted to the Court as part of the Final Joint Pretrial Order. As noted in that submission, IEEE does not object to Dr. Salisbury's qualifications.

pierce the porcine vessels with a micropipette, both with and without his task-level

augmentation code. *Id.* Ex. A at 72, 75. The experiments confirmed the feasibility of

Dr. Kumar's task graph program in a realistic surgical workspace. *Id.* at 72.

It is important to note that in the real world, RVC has never been clinically

performed on humans with steady-hand robotic assistance. Kumar Decl. ¶ 9;

Declaration of Eric M. Stahl ("Stahl Decl.") Ex. N, 64:2-65:15 (Dep. of IEEE

expert). The Thesis is not about RVC. Again, it simply uses RVC as an illustration

of one of the experiments Dr. Kumar devised to test his code. Kumar Decl. ¶ 9.

Dr. Kumar conceived and created a task graph representation of the RVC

experiment. *Id.* ¶ 10 & Ex. A at 70-72, Fig. 5.13:
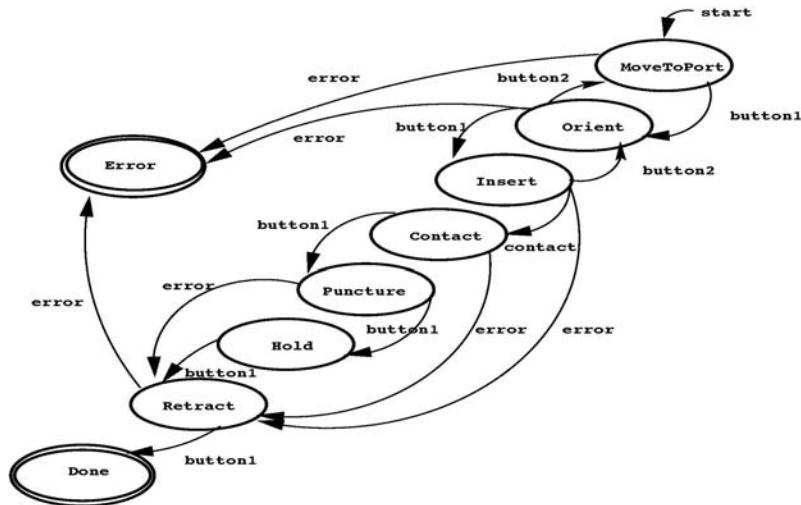
This task graph does not describe the steps necessary to actually perform RVC; rather, it decomposes the surgical process into individual, programmable tasks, at a level of abstraction that Dr. Kumar determined to be appropriate for performing his experiment. Kumar Decl. ¶ 10; Salisbury Decl. ¶¶ 16-21. Each state (e.g., "MoveToPort," "Orient," "Insert,") and each transition (e.g., "button1") signifies substantial code that Dr. Kumar created for this RVC experiment. Kumar Decl. ¶ 11. Were the task graph to reflect an actual surgical procedure, as opposed to a technological demonstration, there would, for example, be no reason to describe "orient" and insert" as separate steps. *Id.* ¶ 10. Moreover, a task graph depicting actual RVC would have included additional tasks and additional detail. For example, although in practice RVC is used to deliver medication into the retinal vessel, the Thesis task graph does not contain a "delivery" task. *Id.*; Stahl Decl. ████████ ████████████████; Ex. N (Hannaford Dep.) 74:4-13 (admission of IEEE's expert); Kumar Decl. Ex. A at 70. In addition, in actual surgery, precision would be improved by adding steps to the task graph, such as a "tracking" task – yet such steps are not reflected in Dr. Kumar's RVC task graph because they were not part of the performed experiment. *Id.* pp. 76-77.

Figure 5.13 is original to Dr. Kumar. He created it to reflect his Thesis RVC experiment as it was coded., and he conceived the individual steps shown therein, their sequence, and their text descriptions. *Id.* ¶ 11 & Ex. A at 70-71. While the task graph reflects Dr. Kumar's general understanding of RVC (based on clinical ophthalmology videos depicting the procedure), it is not based on any pre-existing work. *Id.* ¶ 11.

The Thesis' overall originality is confirmed by the fact that JHU's faculty (including Dr. Hager, who later co-authored the accused IEEE Article) certified that it met JHU Computer Science Department's Ph.D. requirements. Stahl Decl. Ex. P (Hager Dep.) 23:5-16; 36:9-19. JHU requires a doctoral dissertation to be a "large, careful, and substantive piece [of] *original* work." Stahl Decl. Ex. R at 8 (emphasis added); *id.* Ex. Q (Taylor Dep.) 20:13-27:19 (testimony of Kumar's Thesis advisor, noting originality and novelty requirement). The Thesis' original work includes its use of task graphs to instruct the robot to perform complex micromanipulation tasks. *Id.* 65:7-66:13, 84:7-21; *id*. Ex. P (Hager Dep.) 34:20-35:20; *see also* Kumar Decl. Ex. A at 36 (Thesis: "It is a hard problem to decompose a task into several sub-parts that can be monitored and executed simultaneously."); *id.* at 19-20 (describing Thesis "Contributions"); Salisbury Decl. ¶ 23.

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The Thesis is registered with the U.S. Copyright Office. Dr. Kumar is the registered author and sole copyright claimant. Kumar Decl. Ex. D.

B.   The IEEE Article Was Written Primarily By an Inexperienced Researcher In Less Than Six Weeks, With No Substantive Work

After obtaining his Ph.D., Dr. Kumar left JHU for private industry in 2001. Kumar Decl. ¶ 14. The following year, Dr. Greg Hager of JHU's Computer Science department – again, one of the faculty readers who approved the Thesis – invited Danica Kragic to visit JHU as a post-doctoral researcher to work on human-machine micromanipulation. Stahl Decl. ████████████████████; Ex. C. During her brief visit, she and Dr. Hager submitted the accused article in this case, "Task Modeling and Specification for Modular Sensory Based Human-Machine Cooperative Systems," which IEEE published in 2003 (the "IEEE Article"). *Id*. Ex. A (Article); *id.* Ex. T (IEEE Vengraitis Dep.) 22:24-23:10.

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████████████████████. Before coming to JHU, Dr. Kragic admitted

to Dr. Hager that "I can't really say that my experience in this field is great[.]" *Id.*

Ex. D; ████████████████████████████████.

In preparation for Kragic's arrival at JHU, Dr. Hager sent her a series of papers

describing work done at the steady hand lab, including one of Dr. Kumar's

unpublished manuscripts. Stahl Decl. ████████████████████████████████;

Ex. E (unpublished manuscript); Exs. D, F (showing Hager sent Kragic same);

Kumar Decl. ¶ 13 (describing unpublished manuscript). That unpublished work

summarizes the Thesis experiments and contains a version of Dr. Kumar's task graph

depicting the decomposition of RVC. *Id.*; Stahl Decl. Ex. E, p.6 & figure 8; *see*

Kumar Decl. ¶ 13 (discussing same manuscript).

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██. Dr. Kragic sent

the submission version of the article to IEEE on March 16, 2003. ████████████;

Stahl Decl. Ex. G. ████████████████████████████████

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The IEEE Article, just like the Thesis, describes the use of task graphs to

encode and control the steady hand robot in "human-machine cooperative systems,"

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which combine human decision-making with robotic enhancements to perform complex tasks. Stahl Decl. Ex. A (IEEE Article) (Abstract). The IEEE Article describes the same strategy of programming higher level tasks using graphically depicted coding primitives. *Id.* § 2. Like the Thesis, the IEEE Article illustrates this using retinal vein cannulation as an example, and contains a task graph containing the same (non-clinical) task decomposition of RVC as is seen in the Thesis. *Id.* § III, VIII; *see also* Section D below. But unlike Dr. Kumar, the authors of the IEEE Article had no reason to choose RVC as their illustration: while Dr. Kumar identified RVC as a programming example because it provided a way to conduct physical experiments testing the task graph programming solution, the IEEE Article contains no RVC-related experiment, no trials and no results. Stahl Decl. Ex. A. The IEEE Article contains an expression of the RVC task graph ███████████████████ ███████████ – but it is effectively the same as that described in Dr. Kumar's Thesis, simply translated into a different computer language (XML). Stahl Decl. Ex. B ████████████████████████; *id.* Ex. A, Section VIII; *see also* Kumar Decl. ¶ 16.[2]

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[2] XML is simply a "markup language," like HTML. It tells a computer how to process text. *See i4i Ltd. P'ship v. Microsoft Corp.*, 598 F.3d 831, 839-40 (Fed. Cir. 2010). As IEEE's expert explains, XML enables a user to program by "stating what the results should be," in contrast to Dr. Kumar's language, which contains the actual step-by-step instructions to achieve the results. Stahl Decl. Ex. N (Hannaford Dep.) 114:19-117:3. In other words, Dr. Kumar wrote the "actual recipe" for the tasks depicted in the RVC task graph (*id.* 117:2)

Dr. Kragic claims she prepared the IEEE Article's RVC task graph using the same software program (Xfig) that Dr. Kumar used to draw Thesis Fig. 5.13. Kumar Decl. ¶ 21; Stahl Decl. ¶ 9 & Ex. H p. 2; ███████████████. Dr. Kragic produced her Xfig source file in discovery. A side-by-side comparison of the coding in Dr. Kragic's source file to the Xfig source file for Dr. Kumar's figure 5.13 shows that ***Kumar's work was the original source*** for the IEEE Article's task graph. Each element of Dr. Kragic's task graph was created in the same sequence and same manner of construction as Dr. Kumar's original, with the same document settings, formatting and stylistic elements (except that the IEEE Article version rotates the orientation from "portrait" to "landscape"). Each of the task graphs involved entering into Xfig hundreds of individual elements – shapes, text and formatting. They would not have appeared in the same order, with the same formatting and construction choices, unless the figures came from the same source. Kumar Decl. ¶¶ 21-27; Exs. *I* (Kumar source file), J (Kragic source file), K (comparison).

The IEEE Article offers no insight into task-level programming of cooperative human-robot systems that is not also contained in the Thesis. Salisbury Decl. ¶ 31.

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Conclusion); *see also id.* Ex. P (Hager Dep.) 69:16-75:13 (co-author Hager unable

to identify validation described in the Article). █████████████████████

██. Dr. Kragic

produced in discovery her source files for the work described in the IEEE Article.

Id. Ex. H, pp. 2-3; ████████████████████████████████. Those files either

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were derived from Kumar's work (*see* Kumar Decl. ¶¶ 22-27 & Exs. I-K); ███

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no evidence the article authors actually developed any software that ever ran on the

steady hand robot.

C.   The IEEE Article Authors Had Access To The Thesis

The article's authors had access to Dr. Kumar's Thesis, as well as to related

unpublished works expressing the same material. First, as noted above, Dr. Hager

read the Thesis as one of Dr. Kumar's secondary advisors. Stahl Decl. Ex. P

(Hager Dep.) 23:5-16; 36:9-19.

Second, as also noted above, a review of the original Xfig file for IEEE

Article Figure 1 indicates that its source was Dr. Kumar's Xfig file for Thesis

figure 5.13. Kumar Decl. ¶¶ 21-27 & Exs. *I*-K. Dr. Kumar's Xfig file had been

stored for backup purposes on a shared JHU network drive, and would have been

accessible to anyone with administrative access to that network. *Id.* ¶ 22.

Third, the IEEE Article's bibliography cites the Thesis as a source. Stahl

Decl. Ex. A (Reference [6]). The citation is erroneous: it is transposed with a

reference to an unrelated work, in a way that falsely attributes to the Thesis

assertions it does not make and that obscures the extent of the overlap between the

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two works. *Id.* (references 5 and 6); ████████████████████████████; *id.* Ex.

P (Hager Dep.) 100:9-19; Kumar Decl. ¶ 17.[3] Nevertheless, the citation establishes

that the authors had access to the Thesis. ████████████████████████████

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    Fourth, while Dr. Kragic ████████████████████████████████

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███████████ reviewed an unpublished manuscript that Dr. Hager had provided her,

containing an early version of Dr. Kumar's RVC task graph. ████████████████

██; *id.* Ex.

E (manuscript), Figure 8; *id.* Ex. F (Hager notes to Kragic forwarding what he

referred to as the "Kumar TRA submission"); Kumar Decl. ¶ 13. ████████████

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[3] IEEE agreed to correct this one error in December 2012 – but only after this litigation began, and more than nine months after Dr. Kumar brought the obvious transposition to IEEE's attention. Stahl Decl. Ex. AA (IEEE Correction); *id.* Ex. Y (IEEE Dep.) 29:10-16; 31:18-33:10; Kumar Decl. ¶ 17.

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D.   Comparison of Thesis and Article

Virtually everything of substance in the IEEE Article copies or summarizes

material from the Thesis. The similarities cannot be explained away by the fact

that the two works cover the same subject – i.e., programming the JHU steady

hand robot to perform cooperative steady hand micromanipulation, or what the

IEEE Article renames "human-machine cooperative systems." The IEEE Article

mirrors, first, the overall form, content, organization and conclusions of the Thesis

(albeit in abridged form). Salisbury Decl. ¶ 26. More significantly, the article

copies the heart of Dr. Kumar's solution to the "hard problem" of decomposing

complex tasks into sub-tasks that can be monitored and executed simultaneously in

the context of programming the robot to perform precise, jointly controlled tasks.

Kumar Decl. Ex. A at 36. A comparison of the two works reveals that the IEEE

Article appropriates substantial text, graphics and code directly from the Thesis.

Specifically:

1.   The works use almost identical language to describe the task-level

breakdown necessary to control a robotic tool to assist in the RVC experiment.

The Thesis describes the task breakdown as:

> a) positioning the tool at the port, (b) orienting it such
> that it can be inserted, c) insertion of the tool,
> d) adjusting the orientation of the tool for placement …
> e) approaching the site, and f) achieving contact.

Id. at 18; *see also id.* 71-72. The IEEE Article likewise states:

> As an example, retinal vein cannulation involves
> *positioning* and *orienting* of a needle to the vicinity of the
> vein, *inserting* it when appropriate until contact is made.
> On contact, *puncturing* is performed, after which the
> needle can be safely *withdrawn*.

Stahl Decl. Ex. A, Section III; *see also id.* Section VIII.

As noted above, the source of this language is Dr. Kumar: he conceived and

created this step-by-step description of the task decomposition needed to perform

his particular RVC experiment. Kumar Decl. ¶ 11 & Ex. A at 70-71. Tellingly, the

IEEE Article attributes its description of the RVC steps solely to an article about

RVC in the clinical journal *Ophthalmology* – but that source ***does not mention*** any

of the above steps, and contains no language remotely resembling that used in the

IEEE Article. Stahl Decl. Ex. A (citation [7], referring to article by J.N. Weiss);

id. Ex. O (Weiss Article); *id.* Ex. N (Hannaford Dep.) 89:19-90:7.[4]

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[4] If the IEEE Article authors had in fact relied on Weiss for their depiction of RVC, they would have noted that a key purpose of RVC is delivery of a therapeutic drug to the retinal vessel. *Id.* Ex. O (Weiss article) at 2249 (discussing delivery of t-PA). Indeed, therapeutic delivery via RVC is the entire point of the Weiss article, as stated in its Abstract and elsewhere. The IEEE Article, in contrast, contains no mention of the therapeutic use of RVC.

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████████████████████████████████████ Stahl Decl. Ex. L (grant proposal); █

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████ Discovery has identified *no* source for this RVC task decomposition other than Dr. Kumar's Thesis. *Id.* Ex. N (Hannaford Dep.) 93:1-14.

2.   The IEEE Article copies the Thesis' critical task graph – the graphical expression of Kumar's program instructing the steady hand robot to perform augmented, task-level manipulation for his RVC experiment. Kumar Decl. Ex. A at 70 (Thesis Figure 5.13); Stahl Decl. Ex. A (IEEE Article Figure 1). The task graph is the core of both works – the blueprint for the system architecture and visually depiction of the code generated to operate the robot. Salisbury Decl. ¶¶ 27-29. The version in the IEEE Article rotates the image and makes a few cosmetic changes, but the figures express the same tasks, in the same order, for the same purpose. *Id.* ¶¶ 29-30. The two figures share all the attributes needed to make them "strikingly similar" in this field. Stahl Decl. Ex. N (Hannaford Dep.) 82:24-84:15. (The annotations to the two figures below were provided by Dr. Kumar to highlight that 19 of the 22 descriptive elements are identical.)

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From the IEEE Article (Stahl Decl. Ex. A, Figure 1):
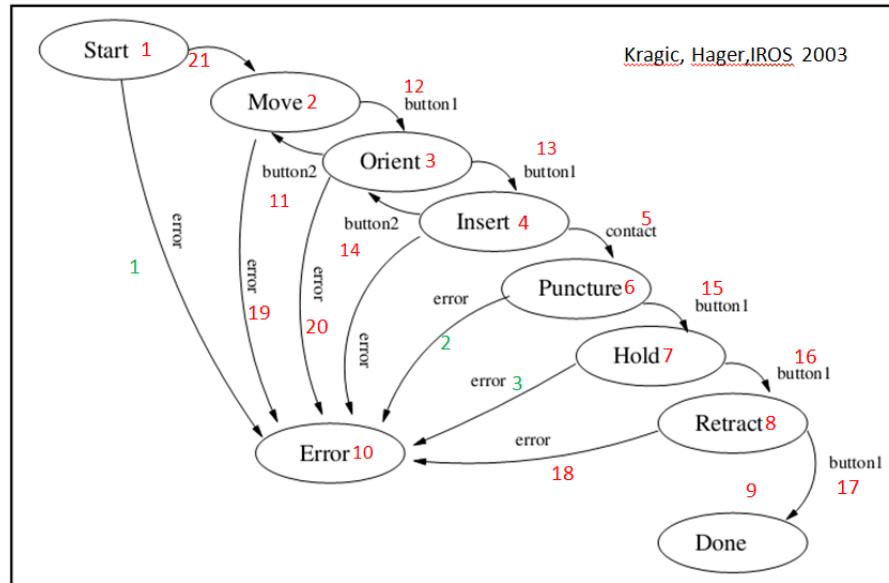
Fig. 1. An example of a basic task graph for vein cannulation.[22]

From the Thesis (Kumar Decl. Ex. A, Figure 5.13):
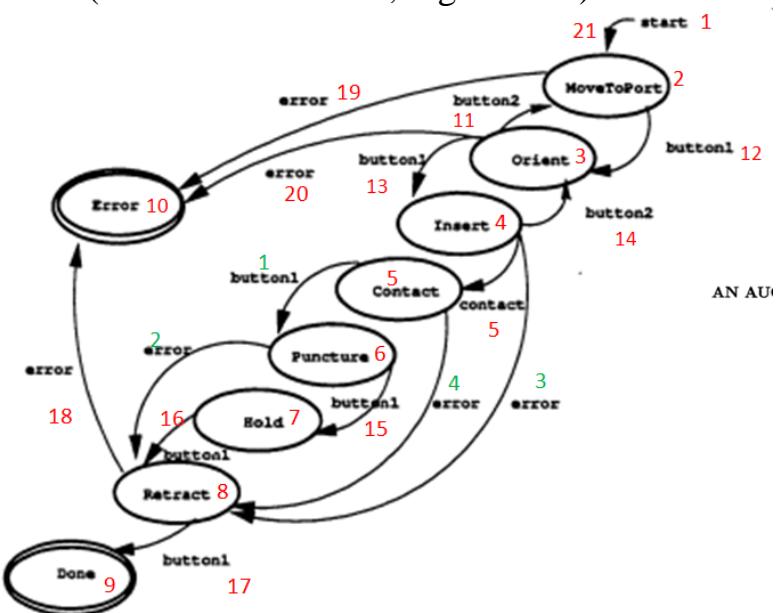
Figure 5.13: Task graph for retinal vein cannulation. [22]

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Figure 5.13 is original to Dr. Kumar. Kumar Decl. ¶ 11. It reflects the

Thesis' unique application of task graphs and related terminology to describe state-

machines in steady hand manipulation. *Id.* Ex. A, Ch. 4; Salisbury Decl. ¶ 14-19.

Notably, when first confronted with Dr. Kumar's claim that the IEEE Article

copied the task graph, ███

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Dr. Hager's immediate reaction ██████████: he found the similarities between the

two figures "troublesome." Stahl Decl. Ex. S; *id.* Ex. P (Hager Dep.) 115:9-116:6;

id. 122:6 (Hager admitting "the similarity is apparent.").

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██████████████████████████████ ; *id.* Ex. L. █████████████████████████████

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In this litigation, IEEE has identified various figures in unrelated contexts that it claims resemble the figures above. But Dr. Kumar does not claim to be the originator of the concept of a task graph or the broader concept of "finite state machines." His claim is that he created this unique task graph depiction of his RVC experiment. Notably, IEEE's expert witness attempted to locate another example of a task graph depiction of RVC – and failed to find a single one. Stahl Decl. Ex. N (Hannaford Dep.) 53:3-17; 93:1-14; *see also id.* Ex. Q (Taylor Dep.) 91. The *only* such task graph is the one Dr. Kumar created and the IEEE Article copied.[5]

3.   Section VIII of the IEEE Article ("Example Scenario") expresses in XML language the same steps shown visually by the RVC task graph, and thus amounts to the same computer program that the Thesis describes in a different language. Stahl Decl. Ex. A (Article) § VIII; Kumar Decl. ¶ 16 & Ex. A (Thesis) Appendix B, page 99; Salisbury Decl. ¶ 31.

4.   Section IV of the IEEE Article ("Basic Primitives") contains routines and primitives – *i.e.*, programming instructions – taken entirely from the Thesis.

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[5] Kragic and Hager later used the same task graph (IEEE Article Figure 1) in works they co-authored with other collaborators. The publishers of these later works have all issued statements or errata noting Kumar *should have been acknowledged* in connection with the task graph. Kumar Decl. ¶ 18 & Ex. E, F. IEEE is the lone holdout.

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The framework, task elements and terminology that the Article uses to express these instructions are all lifted from the Thesis. *See* Kumar Decl. Ex. A at 45 (figure 4.4), 56 (figure 5.2), 69-72 and figure 5.13; 97 (describing implementation of the primitives); Stahl Decl. Ex. A § IV. The "move," "orient" and "insert" primitives described in section IV.A (second column) of the Article are identical to those described in the Thesis. *See id.*; Kumar Decl. Ex. A, chapters 4, 5 and pp. 96-97; Salisbury Decl. ¶ 32.

5.   The article copies, practically *verbatim*, the Thesis' description of the steady hand robot hardware. Kumar Decl. Ex. A at 22-23; Stahl Decl. Ex. A § III (last full paragraph).

6.   The two works describe their objectives in uncannily similar terms: the Thesis' goal is to "augment human actions in medicine" where "precision, efficiency, and consistency" are required; likewise, the IEEE Article's goal is "augmenting surgical manipulation tasks" which are "repetitive, sequential and consist of simple steps." Stahl Decl. Ex. A (Abstract); Kumar Decl. Ex. A at 9.

7.   The Thesis and IEEE Article use the same expressive content to describe the robot's software architecture: "A modular architecture was designed for controlling the steady hand robot. This architecture is suitable for several other surgical robot applications[.]" *Id.* at 20. "The system has to be modular – complex

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tasks should be defined using a set of basic control primitives. This allows the

surgeon to model a variety of tasks using the existing architecture." Stahl Decl.

Ex. A, § I.

> **8.**   The two works use nearly identical terms to describe the software

controls used to manipulate the robot. For example, the Article discusses the robot

"as a purely kinematic Cartesian device," with specific inputs for controlling the

tool tip position and velocity. *Id.* § IV.A. The Thesis likewise explains that "for

moving to a specified frame, Cartesian control simply involves performing inverse

kinematics on the given frame and moving with obtained joint parameters."

Kumar Decl. Ex. A at 29; *id.* at 25-27 (discussing kinematic parameters).

E.   Subsequent Developments

Dr. Kumar was not aware of the IEEE Article's publication in 2003. Kumar

Decl. ¶ 15. It was published without his knowledge or permission. *Id.*

Dr. Kumar returned to JHU in 2007 as an assistant research professor,

working on research unrelated to his Thesis topics. *Id.* In 2010, while preparing a

grant application to the National Science Foundation for JHU, Dr. Kumar

discovered the IEEE Article. *Id.* He had no prior knowledge of its existence. *Id.*

Dr. Kumar recognized immediately that the article was based on his Thesis.

Id. ¶16. Because it was co-authored by a JHU colleague (Dr. Hager, by then chair

of the Computer Science Department), he attempted first to have his concerns

resolved internally. *Id.* A JHU dean conducted a summary inquiry into Dr.

Kumar's allegations, construing them as a claim of research misconduct. While

JHU found no violations of the university's research misconduct policies, the

inquiry did not consider the issue of copyright infringement. Stahl Decl. Ex. CC at

RK-IEEE000904 (JHU letter noting "Alleged violations of copyright are beyond

the scope of institutional review."); *see id.* Ex. BB (Douglas Dep.) 77:11-21.[6]

Dr. Kumar also alerted IEEE of his concerns with the IEEE Article. Stahl

Decl. Ex. T (IEEE Vengraitis Dep.) 62:14-24. IEEE admits its initial investigation

of Dr. Kumar's complaint violated IEEE's own written policies, because it

assigned the investigation to a single IEEE officer rather than a required

independent, "ad hoc" committee of experts. *Id.* 52:18-53:13; 74:18-75:21.

Worse, the single IEEE officer had clear conflicts of interest: ██████████

████████████████████████████; and he had advised a grad student who

had preceded Dr. Kragic at JHU and had co-authored articles with Dr. Hager███

████████████████████████; Kumar Decl. ¶ 20 & Ex. H.

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[6] JHU later wrongfully retaliated against Dr. Kumar's employment for his pursuit
of the complaint. Kumar Decl. ¶ 19 & Ex. G (2014 jury verdict) at 3.

[REDACTED]

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7 [REDACTED] "***Even if this figure should have been acknowledged*** in such way that the figure is derived from Kumar's figure," there was no finding of plagiarism according to IEEE's policies. *Id.* Ex. X (emphasis added). [REDACTED]

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F.   Procedural Background

Dr. Kumar filed his complaint in this action on November 5, 2012. Dkt.

No. 1. It alleges the IEEE Article infringes his exclusive rights under the

Copyright Act to reproduce, distribute, display, and prepare derivative works from

the Thesis. He seeks damages, a declaratory judgment that unauthorized use of his

Thesis constitutes infringement, and an injunction against IEEE's further

exploitation of the IEEE Article. *Id.* at 5-6.

IEEE moved to dismiss the complaint as failing to allege the Article copied

protectable content from the Thesis, and because the works allegedly were not

substantially similar. Dkt. No. 13. This Court denied the motion in a 13-page

opinion, holding Kumar "adequately pleads copyright infringement." Dkt. No. 48.

The parties have engaged in substantial discovery, which is now complete.

III.   ARGUMENT

A.   Legal Standards

A copyright plaintiff is entitled to summary judgment on copyright

infringement liability if he shows that there is no genuine material dispute as to

"(1) ownership of a valid copyright; and (2) unauthorized copying of original

elements of the plaintiff's work" by defendant. *Kay Berry, Inc. v. Taylor Gifts,*

Inc., 421 F.3d 199, 203 (3d Cir. 2005) (citing *Dun & Bradstreet Software Servs.,*

Inc. v. Grace Consulting, Inc., 307 F.3d 197, 206 (3d Cir. 2002)); *Journal of African Civilizations Ltd. v. Transaction Publishers*, 2013 WL 6498983, at *2-3 (D.N.J. Dec. 11, 2013); Fed. R. Civ. P. 56(a).

As to <u>ownership</u>: a copyright registration provides *prima facie* evidence of both copyright validity and ownership. *Educ. Testing Servs. v. Katzman*, 793 F.2d 533, 538 (3d Cir. 1986); 17 U.S.C. § 410(c). Here, Dr. Kumar registered the Thesis in 2001, the same year it was published. Kumar Decl. Ex. D. His ownership of the Thesis is therefore presumed (and has never been disputed).

As to <u>copying</u>, this element is met where defendant infringes "any of the exclusive rights that accrue to the owner of a valid copyright, as set forth at 17 U.S.C. § 106[.]" *Kay Berry*, 421 F.3d at 207. These include the exclusive rights to reproduce and distribute the work, and to prepare derivative works based on it. 17 U.S.C. §§ 106, 501(a). Here, it is not disputed IEEE copied and distributed the IEEE Article; it remains available for distribution today, and copies have been purchased from IEEE both before and after this litigation began. Stahl Decl. Ex. Y (IEEE Durniak Dep.) 47:15-21. To constitute infringement, the "copying" must be impermissible. That is the case here, as explained in the remainder of this brief.

B.   Copying Is Established Here By Direct Evidence

Unauthorized copying may be demonstrated by either "direct evidence" of

the infringement, as where the defendant has made a literal copy of the plaintiff's

protected expression, *Whelan Assocs., Inc. v. Jaslow Dental Lab., Inc.*, 797 F.2d

1222, 1231, 1237 (3d Cir. 1986), or inferentially, by showing "defendant had

access to the copyrighted work and that the original and allegedly infringing works

share substantial similarities." *Kay Berry*, 421 F.3d at 207-08.

Direct evidence of copying, while "rarely" found in copyright cases, *Whelan*

Assocs., 797 F.2d at 1231, can be shown through proof that the defendant copied

coding or other embedded elements from the plaintiff's original work. *See, e.g.*,

M. Kramer Mfg. Co. v. Andrews, 783 F.2d 421, 445-46 (4th Cir. 1986) (duplication

of hidden legend from video game, and identity of many lines of object code,

established copying); *Broderbund Software, Inc. v. Unison World, Inc.*, 648 F.

Supp. 1127, 1135 (N.D. Cal. 1986) (verbatim program instructions direct evidence

code was copied); *Koontz v. Jaffarian*, 617 F. Supp. 1108, 1114-15 (E.D. Va.

1985) (repetition of modifications and errors indicated defendant's tabulation was

prepared by referring to plaintiff's work), *aff'd*, 787 F.2d 906 (4th Cir. 1986).

Here, direct copying of Dr. Kumar's RVC task graph is established by the

software source files Dr. Kragic produced in discovery. As noted in Section II.B

above, the Xfig source file for Dr. Kragic's task graph (IEEE Article Fig. 1) shows

its elements were drawn in the same sequence, using the same manner of

construction as Dr. Kumar's original RVC task graph, with the same settings,

formatting and stylistic elements. Kumar Decl. ¶¶ 21-27 & Exs. I-K. Given that

coding in XFIG requires manual entry of hundreds of individual elements, there is

no practical explanation for the literal copying present in these two files other than

that Dr. Kumar's file was Dr. Kragic's source. *Id.* ¶ 27. The files are not identical;

for example, at the outset Dr. Kragic rotates Dr. Kumar's figure by changing the

orientation from "Landscape" to Portrait, and transposes some otherwise identical

blocks of code. *Id.* Ex. K. But such minor dissimilarities are "the result of a

studied effort to make minor distinctions between the two works," which in itself

"constitutes compelling evidence of copying is itself." *M. Kramer Mfg.*, 783 F.2d

at 446.

Dr. Kragic's Xfig source file provides sufficient "direct evidence" that the

IEEE Article copied protected expression from the Thesis. This alone suffices to

establish Defendant's liability for infringement.

C.   Copying Is Established Here By Inferential Evidence

Independently, impermissible copying is inferred from a showing that the

defendant (i) had access to the copyrighted work, and (ii) the copyrighted and

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allegedly infringing works are "substantially similar." *Whelan Assocs.*, 797 F.2d at 1231-32; *Franklin Mint Corp. v. Nat'l Wildlife Art Exchange, Inc.*, 575 F.2d 62, 64 (3d Cir. 1978). Both elements are met here.

1.   The Authors of the IEEE Article Had Access to the Thesis When They Prepared Their Article

To prove "access" in this context, "All that is required is a ***reasonable possibility*** that a defendant had an ***opportunity*** to view a copyrighted work." *Midway Mfg. Co. v. Bandai-America, Inc.*, 546 F. Supp. 125, 146 (D.N.J. 1982) (emphasis added) (quoting *Ferguson v. Nat'l Broad. Co.*, 584 F.2d 111, 113 (5th Cir. 1978)). The access requirement is met if it was sufficient to provide "the opportunity to copy." 4 NIMMER ON COPYRIGHT § 13.02[A] (2014). "Unusual speed in the creation of defendant's work may furnish some evidence that defendant had access to and used plaintiff's work rather than resorting to independent creation." *Id.* § 13.02[C].

Here, there is no question the authors of the IEEE Article had access to, and the opportunity to copy, the Thesis at the time they wrote the article. As detailed previously: (1) Dr. Hager was a secondary advisor on the Thesis; (2) the IEEE Article itself purports to cite the Thesis; (3) the Xfig source files show Dr. Kragic had access to an electronic copy of Dr. Kumar's RVC task graph, which had been stored on a shared JHU server; and (4) ███████████████████████

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██████, unpublished material containing a version of the task graph. *See* § II.C, *supra*, and citations therein. ████████████████████████████████

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████████████████████████████████████ – further supports a finding that she had access to the prior work. Stahl Decl. Ex. G; ███████████████.

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████████ *Abkco Music, Inc. v. Harrisongs Music, Ltd.*, 722 F.2d 988 (2d Cir. 1983) (noting unlawful copying of protected work may occur "subconsciously").

2. The IEEE Article Is Substantially Similar To The Thesis

The final element, "substantial similarity," is also easily satisfied here. The substantial similarity test calls upon the court to "consider whether there has been infringement by comparing the allegedly infringing works against the original work." *Granger v. Acme Abstract Co.*, 900 F. Supp. 2d 419, 424 (D.N.J. 2012) (citing *Dam Things From Denmark v. Russ Berrie & Co.*, 290 F.3d 548, 562 (3d Cir. 2002)). This generally requires a two-part analysis. "First, the fact-finder must decide whether there is sufficient similarity between the two works in question to conclude that the alleged infringer used the copyrighted work in

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making his own." *Whelan Assocs.*, 797 F.2d at 1232. Expert testimony is permitted in support of this "extrinsic test," "to help reveal the similarities that a lay person might not ordinarily perceive." *Kay Berry*, 421 F.3d at 208.

Second, if the Court finds there was such actual copying, it next considers – without expert testimony – whether, from an "ordinary observer's" perspective, "the copying was 'illicit,' or 'an unlawful appropriation' of the copyrighted work," *Whelan Assocs.*, 797 F.2d at 1232, or, in other words, whether the copying reached "protectible aspects" of the work. *Dam Things From Denmark*, 290 F.3d at 562. This requires not a detailed analysis, but rather the court's "impressions as they would appear to a layman viewing the [works] side by side;" the task is to "concentrate upon the gross features rather than an examination of minutiae." *Universal Athletic Sales Co. v. Salkeld*, 511 F.2d 904, 908-09 (3d Cir. 1975).

When the copyrighted work at issue is complex, the bifurcated substantial similarity test becomes a "single…inquiry" permitting both lay and expert testimony. *Whelan Assocs.*, 797 F.2d at 1232-33. The Court must "make a qualitative, not quantitative, judgment about the character of the work as a whole and the importance of substantially similar portions of the work." *Id.* at 1245-46.

Under either test, the IEEE Article is "substantially similar" to the Thesis.

Extrinsic copying: First, both expert and lay testimony indisputably demonstrate that the IEEE Article "is not itself original, but rather is based on the [Thesis]", and therefore is "extrinsically" similar. *Kay Berry*, 421 F.3d at 208.

As set out in the expert declaration of Stanford University computer science professor Kenneth Salisbury, the IEEE Article "offers no insight into task-level programming of cooperative human-robot systems that is not also contained in the Thesis," Salisbury Decl. ¶ 33, but instead "essentially abridges the Thesis and its key conclusions, minus the experimental validation[.]" *Id.* ¶ 26. The core of both works – the RVC task graphs (Thesis Fig. 5.13 and IEEE Article Fig. 1) – are the same, save for "cosmetic" and "superficial" changes unrelated to Dr. Kumar's unique way of expressing "graphically the sequence of actions occurring in this complex, robot-augmented task[.]" *Id.* ¶¶ 27, 30. Dr. Salisbury further explains why the similarities between the task graphs, the manner and content of the RVC task decomposition it expresses, and the primitives presented, are all significant in the field of robotics. See, in particular, *id.* ¶¶ 10, 15-19, 27-30. Dr. Salisbury also confirms that the IEEE Article's "Example Scenario" and "Basic Primitives" sections likewise are functionally the same as the descriptions, instructions and coding contained in the Thesis. *Id.* ¶¶ 31, 32.

Abundant factual evidence also conclusively demonstrates substantial similarity sufficient to infer copying. *See* § II above. To summarize the key evidence set out previously:

- The source file for Dr. Kragic's RVC task graph indicates it was literally copied from the Xfig file of Dr. Kumar's Figure 5.13. Kumar Decl. ¶¶ 21-27 & Exs. I-K. This demonstrates "substantial similarity" in addition to direct copying (*supra*, § III.B).

- No example of any RVC task decomposition or any RVC task graph predating the Thesis has been identified. And the *only* subsequent example is from the authors of the IEEE Article. Stahl Decl. Ex. N (Hannaford Dep.) 53:3-17; 93:1-14; *id.* Ex. Q (Taylor Dep.) 91.

- ██ ██ ██████████████████████████████████████, all suggest the article was in fact prepared with reliance on the Thesis. *See* § II.B, *supra*, and citations therein.

- The IEEE Article's purported citation for its decomposition of RVC (the Weiss article) is not even remotely on point. Stahl Decl. Ex. O. ████ ██ ██

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Id. Ex. L; ████████████████████████████████████. This is further

evidence that the real source for the authors was Kumar's Thesis.

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- The admission of Dr. Hager that the similarity between the two task

graphs was "apparent," and "troublesome." *Id.* Ex. P (Hager Dep.) 122:6; Ex. S.

- The admission of IEEE's expert witness that such task graphs are

"strikingly similar." *Id.* Ex. N (Hannaford Dep.) 82:24-84:15.

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██████████████████. *See* § II.E, *supra* (last paragraph) and citations therein.

Ordinary observer test: A "side by side" comparison of the work, without

expert opinion or a granular focus on "minutiae," confirms the IEEE Article's

unlawful appropriation of the Thesis. *Universal Athletic Sales*, 511 F.2d at 908-09;

Whelan Assocs., 797 F.2d at 1232. The overall similarity of form, content,

organization and conclusions is apparent from reading the two works. Kumar Ex. A; Stahl Ex. A. To be sure, the article is far less detailed than the Thesis, and lacks the Thesis' experimental validation of the code (███████████████████████ ██). *Id.* (Abstract and Conclusion). But the problem the article addresses and the solution it proposes are the same as the Thesis, expressed in substantially the same language; it contains nothing new.

Section II.D above addresses eight specific and important points of similarity. For most of them, the gross similarity of text and graphics is readily apparent to the lay observer. *See id.* points 1 (description of RVC decomposition), 2 (the task graph), 3 (the "Example Scenario," to the extent it contains the same RVC actions), 5 (verbatim description of the hardware), and 6-8 (descriptions of each work's respective objectives, software architecture and software controls).

Point 3 (in part) and point 4 (primitives) are more closely tied to the works' discussion of computer code, and thus may be better suited to *Whelan*'s unitary test, as noted below. But in both cases the similarities are also supported by lay testimony and the ordinary observer test. Point 4, the similarity of the IEEE Article's section on "Basic Primitives" to the Thesis's description and implementation of the same primitives, may be discerned by comparing the

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framework, task elements and terminology in the two works. Specifically, IEEE Article, § IV can be traced to the Thesis (Kumar Decl. Ex. A) at 45 (Figure 4.4), 56 (Figure 5.2), 69-72 and; 97 (describing implementation of the primitives). The "move," "orient" and "insert" primitives described in section IV.A (second column) of the IEEE Article are identical to those described in the in chapters 4 and 5 of the Thesis. Kumar Decl. Ex. A; *see also id.* at 96-97. As to point 3, the computer program discussed at § VIII of the IEEE Article (the XML representation

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specified in the Thesis, translated into a different language. *See* Kumar Decl. ¶ 16 & Ex. A (Thesis) Appendix B at 99; ██ .

Such a translation amounts to a "derivative work" of the original, 17 U.S.C. § 101, and thus also infringes the copyright owner's exclusive rights. "[I]t is as clear an infringement to translate a computer program from, for example, FORTRAN to ALGOL, as it is to translate a novel or play from English to French." *Synercom Tech., Inc. v. Univ. Computing Co.*, 462 F. Supp. 1003, 1013 n.5 (N.D. Tex. 1978).

Whelan: The foregoing comparison of the two works is only enhanced if, as permitted under *Whelan*, the Court considered expert testimony to evaluate the qualitative significance of the substantially similar portions of the work. *Whelan Assocs.*, 797 F.2d at 1232-33.

First, Dr. Salisbury's testimony confirms that the IEEE Article's expression

of the RVC tasks in the XML language, and its primitives (points of comparison 3

and 4 discussed above) are qualitatively and significantly identical to Dr. Kumar's

Thesis. Salisbury Decl. ¶¶ 32, 33. In the context of computer programs, the Third

Circuit recognizes that courts "are concerned with the overall similarities between

the programs" and thus "must ask whether the most significant steps of the

programs are similar." *Whelan Assocs.*, 797 F.2d at 1246. Here, Dr. Salisbury

confirms virtually all of the code in the IEEE Article is similar to that in the Thesis.

Second, the structure of such programs is protectable expression where there

"are many ways that the same data may be organized, assembled, held, retrieved

and utilized." *Id.* at 1238. Here, Dr. Kumar has established that his text, code and

graphic expression are hardly the only way to describe task modeling of joint

human-machine tasks. First, his choice to use RVC to illustrate his programming

solution was based on the particulars of his chosen experiment. Kumar Decl. ¶ 8.

The article authors – ███████████████████████ – had no legitimate reason to

choose the same illustration. Second, even if the article authors' choice of example

were motivated by some reason other than copying, there are many other ways the

RVC task could have been illustrated and programmed – including with more or

fewer steps, additional detail, or introduction of a therapeutic "delivery" step that

would have more accurately reflected real-world RVC. *Id.* ¶ 10; Salisbury Decl. ¶ 17; Stahl Decl. Ex. N (Hannaford Dep.) 74:4-13. Thus, the choice of RVC cannot be "filtered out" or explained away as the only way to express the concepts in the IEEE Article.

Nor can IEEE's copying be excused on the ground that task graphs are common. Again, there is no evidence that a task graph depicting RVC in the manner Dr. Kumar chose has been created by anyone, other than the authors of the IEEE Article. *See* Salisbury Decl. ¶ 20. Dr. Kumar's figure is the creative, original, protectable expression of his experiment. *Id.* The Third Circuit has held that this precise type of expression – that is, graphing and breaking down of program tasks into smaller units that can be efficiently executed – is at the heart of the creative expression found in computer programs. *Whelan Assocs.*, 797 F.2d at 1229-30, 1239. Such programming decisions are protected by copyright, and are infringed to the extent they are original and are copied without authorization. *Id*.

In sum, the Thesis contains text, illustrations and graphics creatively expressing Dr. Kumar's innovative experiment. The IEEE Article copies these items. The text decomposition is substantively identical, and the similarities cannot be explained as the inevitable way to express RVC. The task graphs are strikingly similar on their face, and Dr. Kragic's minor alterations of individual

elements is not enough to excuse her copying of the creative heart of Dr. Kumar's original task graph. The IEEE Article also copies, largely verbatim, substantial portions of the Thesis' specific routines and "primitives" used to program the robot, altered only by the superficial translation into XML. Given these similarities, as well as the direct evidence of copying and the uncontroverted evidence that the article authors had access to the Thesis material and did no original work of their own, Dr. Kumar is entitled to a summary judgment of infringement.

IV. CONCLUSION

For the foregoing reason, this Court should grant the motion and enter summary judgment in favor of Dr. Kumar on IEEE's liability for copyright infringement, and on his entitlement to declaratory judgment that the IEEE Article is infringing.

Dated: Hackensack, NJ   BIENSTOCK & MICHAEL, P.C.
      February 20, 2015

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